Claims

[c1]   A laminate for use in making a thermoformed article, the laminate comprising:

first and second strengthening layers and a core layer disposed between the strengthening layers, with the strengthening layers providing the predominate flexural rigidity for the laminate and the core layer providing the predominate sound absorption for the laminate;

the core layer comprises a batt of nonwoven thermoplastic fibers comprising:

20-50% fine fibers with a denier in the range of 0.8-3.0; and

10-50% binder fibers for at least binding together the fine fibers; and

regular fibers having denier in the range of 4.0-15 denier;

the first and second strengthening layers comprise a batt of nonwoven polymeric fibers comprising:

regular fibers having a denier greater than the fine fibers of the core layer and in an amount to provide flexural rigidity to the laminate.

[c2]   A laminate according to claim 1 wherein the thermoplastic fibers include polyester, polyolefins, and nylon.

[c3]   A laminate according to claim 2 wherein the polyester fibers include bicomponent fibers.

[c4]   A laminate according to claim 3 wherein the binder fibers have a denier in the range of 0.8-200.

[c5]   A laminate according to claim 4 wherein the binder fibers have a denier in the range of 6-25.

[c6]   A laminate according to claim 1 wherein the core layer batt has a basis weight in the range of 6-12 ounces/yd^2.

[c7]   A laminate according to claim 6 wherein the unmolded core layer batt has a thickness of 0.5-1.0 inches.

[c8]   A laminate according to claim 1 wherein the core layer batt has a basis weight of 6-24 ounces/yd^2.

[c9]   A laminate according to claim 8 wherein the unmolded core layer batt has a thickness of 0.5-2.0 inches.

[c10]   A laminate according to claim 1 wherein the binder fibers comprise bicomponent fibers.

[c11]   A laminate according to claim 1 wherein the binder fibers comprise low melting point fibers.

[c12]   A laminate according to claim 1 wherein the core layer batt comprises 35-45% by weight fine fibers having a denier of 0.8-1.2, 20-30% by weight fibers having a denier of 10-15, and the binder fibers comprise 30-40% by weight bicomponent fibers having a denier of 4-15.

[c13]   A laminate according to claim 12 wherein the core layer batt comprises about 40% by weight fine fibers having a denier of about 1.0, about 25% by weight regular fibers having a denier of about 15, and about 35% by weight bicomponent fibers having a denier of about 5.

[c14]   A laminate according to claim 12, and further comprising a first and second web adhesive layer, the first web adhesive layer is disposed between the core layer and the first strengthening layer, and the second web adhesive is disposed between the core layer and the second strengthening layer, whereby the web adhesives enhance the bonding between the strengthening layers and the core layer.

[c15]   A laminate according to claim 14 wherein the web adhesive is a sheet of nonwoven polyester fibers.

[c16]   A laminate according to claim 1, and further comprising a first and second web adhesive layer, the first web adhesive layer is disposed between the core layer and the first strengthening layer, and the second web adhesive is disposed between the core layer and the second strengthening layer,

whereby the web adhesives enhance the bonding between the strengthening layers and the core layer.

[c17]   A laminate according to claim 16, and further comprising a cover material bonded to the lower surface of the second strengthening layer.

[c18]   A laminate according to claim 1 wherein the strengthening layer batts comprise:
50-100% by weight polymeric fibers with a denier of 0.8-200, and
0-50% by weight binder materials.

[c19]   A laminate according to claim 18 wherein the binder materials are binder fibers.

[c20]   A laminate according to claim 18 wherein the polymeric fibers have a denier of 3-25.

[c21]   A laminate according to claim 20 wherein the strengthening layer batts have a basis weight of 3-24 ounces/yd^2.

[c22]   A laminate according to claim 21 wherein the unmolded strengthening layer batts have a thickness of 0.1-1.0 inches.

[c23]   A laminate according to claim 22 wherein the binder materials incude a thermosetting resin.

[c24]   A laminate according to claim 23 wherein the thermosetting resin is a powder which is present in an amount up to 20% by weight in the strengthening layers.

[c25]   A laminate according to claim 1, wherein the core layer regular fibers from the balance of the fiber in the core layer.

[c26]   A laminate according to claim 1, wherein the strengthening layers have a greater density than the core layer.

[c27]   A laminate according to claim 26, wherein the strengthening layers are

thinner than the core layer.

[c28]   A laminate according to claim 27, wherein the core layer has a greater resistivity than the strengthening layers.

[c29]   A laminate according to claim 1, wherein each strengthening layer comprises less than 20% fine fibers.

[c30]   A laminate according to claim 29, wherein the core layer comprises at least 25% fine fibers.

[c31]   A laminate according to claim 1, wherein the percentage of fine fibers in each of the strengthening layers is not greater than half the percentage of fine fibers in the core layer and the fine fibers of each strengthening layer not exceeding 20%.

[c32]   A laminate according to claim 1 wherein the denier of the core layer fine fibers is below 2.7.

[c33]   A headliner for a vehicle comprising:
first and second strengthening layers and a core layer disposed between the strengthening layers, with the strengthening layers providing the predominate flexural rigidity for the headliner to prevent sagging and the core layer providing the predominate sound absorption for the headliner; the core layer comprises a batt of nonwoven thermoplastic fibers comprising:
20-50% fine fibers with a less than 2.7 for absorbing sound; and
10-50% binder fibers for at least binding together the fine fibers; and
the first and second strengthening layers comprise a batt of nonwoven polymeric fibers comprising:
regular fibers having a denier greater than the fine fibers of the core layer and of an amount to provide flexural rigidity to the headliner.

[c34]   A headliner according to claim 33 wherein the thermoplastic fibers include polyester, polyolefins, and nylon.

[c35]   A headliner according to claim 34 wherein the polyester fibers include bicomponent fibers.

[c36]   A headliner according to claim 35 wherein the binder fibers have a denier in the range of 0.8-200.

[c37]   A headliner according to claim 36 wherein the binder fibers have a denier in the range of 6-25.

[c38]   A headliner according to claim 37 wherein the core layer batt has a basis weight of 6-12 ounces/yd^2.

[c39]   A headliner according to claim 38 wherein the core layer batt has a molded thickness of 0.1-1.3 inches.

[c40]   A headliner according to claim 36 wherein the core layer batt has a basis weight of 6-24 ounces/yd^2.

[c41]   A headliner according to claim 40 wherein the core layer batt has an molded thickness of 0.1-1.5 inches.

[c42]   A headliner according to claim 33 wherein the binder material comprises a thermosetting resin.

[c43]   A headliner according to claim 42 wherein the thermosetting resin comprises up to 20% of the core layer.

[c44]   A headliner according to claim 33 wherein the core layer batt comprises 35-45% fine fibers having a denier of 0.8-1.2, 20-30% regular fibers having a denier of 10-15, and the binder materials comprise 30-40% bicomponent fibers having a denier of 4-15.

[c45]   A headliner according to claim 44 wherein the core layer batt comprises about 40% fine fibers having a denier of about 1.0, about 25% regular fibers having a denier of about 15, and about 35% bicomponent fibers having a denier of about 5.

[c46]   A headliner according to claim 45, and further comprising a first and second web adhesive layer, the first web adhesive layer is disposed between the core layer and the first strengthening layer, and the second web adhesive layer is disposed between the core layer and the second strengthening layer, whereby the web adhesives enhance the bonding between the strengthening layers and the core layer.

[c47]   47.A headliner according to claim 46 wherein the web adhesive is a sheet of nonwoven polyester fibers.

[c48]   A headliner according to claim 46 wherein the strengthening layer batts comprise:
50-100% by weight polymeric fibers with a denier of 0.8-200, and
0-50% by weight binder materials.

[c49]   The headliner according to claim 48, wherein the core layer regular fibers have a denier between 4-15.

[c50]   The headliner according to claim 48, wherein the polymeric fibers have a denier of 3-25.

[c51]   The headliner according to claim 50, wherein the polymeric fibers are thermoplastic fibers.

[c52]   A laminate for use in making a thermoformed article, the laminate comprising:
first and second strengthening layers and a core layer disposed between the strengthening layers, with the strengthening layers providing the predominate flexural rigidity for the laminate and the core layer providing the predominate sound absorption for the laminate;
the core layer comprises a batt of nonwoven thermoplastic fibers comprising:
20-50% fine fibers with a denier in the range of approximately 0.8-3.0 denier for absorbing sound;
10-50% binder fibers for at least binding together the fine fibers; and

the balance of regular fibers having a denier in the range of about 4.0-15.0;

the first and second strengthening layers comprising a batt of nonwoven

polymeric fibers and have a density greater than the core layer.

[c53]   The laminate according to claim 52, wherein the polymeric fibers comprise

regular fibers having a denier greater than the fine fibers of the core layer

and of an amount to provide structural rigidity to the laminate.

[c54]   The laminate according to claim 53, wherein the strengthening layers are

thinner than the core layer.

[c55]   The laminate according to claim 54, wherein the core layer has a greater

resistivity than the strengthening layers.

[c56]   The laminate according to claim 55, wherein each strengthening layer

comprises less than 20% fine fibers.

[c57]   The laminate according to claim 56, wherein the core layer comprises at

least 25% fine fibers.

[c58]   The laminate according to claim 57, wherein the percentage of fine fibers in

each of the strengthening layers is not greater than half the percentage of

fine fibers in the core layer and the fine fibers of each strengthening layer

not exceeding 20%.

[c59]

A laminate for use in making a thermoformed article, the laminate

comprising:

first and second strengthening layers and a core layer disposed between the

strengthening layers, with the strengthening layers providing the

predominate flexural rigidity for the laminate and the core layer providing

the predominate sound absorption for the laminate;

the core layer comprises a batt of nonwoven thermoplastic fibers

comprising:

20-50% fine fibers with a denier in the range of approximately 0.8-3.0

denier for absorbing sound; and

10–50% binder fibers for at least binding together the fine fibers; and the first and second strengthening layers comprise a batt of nonwoven polymeric fibers and the core layer has a resistivity greater than at least one of the first and second strengthening layers.

[c60] The laminate according to claim 59, wherein the first and second strengthening layers comprise a batt of nonwoven polymeric fibers comprising regular fibers having a denier greater than the fine fibers of the core layer and of an amount to provide structural rigidity to the laminate.

[c61] The laminate according to claim 59, wherein the strengthening layers are thinner than the core layer.

[c62] The laminate according to claim 59, wherein each strengthening layer comprises less than 20% fine fibers.

[c63] The laminate according to claim 62, wherein the core layer comprises at least 25% fine fibers.

[c64] The laminate according to claim 58, wherein the percentage of fine fibers in each of the strengthening layers is not greater than half the percentage of fine fibers in the core layer and the fine fibers of each strengthening layer not exceeding 20%.